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AN UNUSUAL EXAMPLE OF TERATOGENESIS IN THE FLEA *THRASSIS FOTUS* FROM COLORADO (SIPHONAPTERA: CERATOPHYLLIDAE)

Tom G. Schwan and David S. Dobkin

(TGS) Division of Entomology and Parasitology, University of California, Berkeley, California 94720; (DSD) Natural Resource Ecology Laboratory, Department of Zoology and Entomology, Colorado State University, Fort Collins, Colorado 80523; present address: Department of Zoology, University of California, Berkeley, California 94720.

Abstract.—A female *Thrassis fotus* (Jordan), collected from a deer mouse, *Peromyscus maniculatus* (Wagner), in Weld Co., Colorado, displayed teratogenic defects of the mesothorax and middle legs. Fusion and loss of segments of the two middle legs resulted in only one reduced middle leg, being neither right nor left, which arises midventrally. A photograph of this flea is presented, and the abnormalities are described and figured. Other abnormalities reported for Siphonaptera are reviewed.

The first review of teratogenic deformities in fleas (Smit, 1949a) reported the doubling of the receptaculum seminis (spermatheca), asymmetry of genal ctenidia, and shortening of spines and bristles. In subsequent papers Smit (1949b, 1952, 1953) reported another case of spermathecal duplication and abnormalities of the genitalia causing castration in male fleas. Brinck-Lindroth and Smit (1973) reviewed abnormalities associated with parasitic nematode infestations and presented more examples of male castration as well as female castration and intersexuality. Poinar and Nelson (1973) also reviewed examples of castration in New and Old World fleas. In fact, most reported cases of abnormalities in fleas deal with genitalia and structures that display secondary sexual dimorphism (e.g. the head); very few reports are concerned with deformities of the legs. Claassens (1967) described minor abnormalities in the legs of a male *Ceratophyllus gallinae* (Schrank) from Ireland which showed slight alterations in the marginal outlines of all coxae, one femur, tibia, and tarsomere. Sanjean and Travis (1955) reported an eight-legged *Orchopeas howardi howardi* (Baker) from New York which had a small distorted fourth pair of legs attached posteriorly to the metathoracic segment.

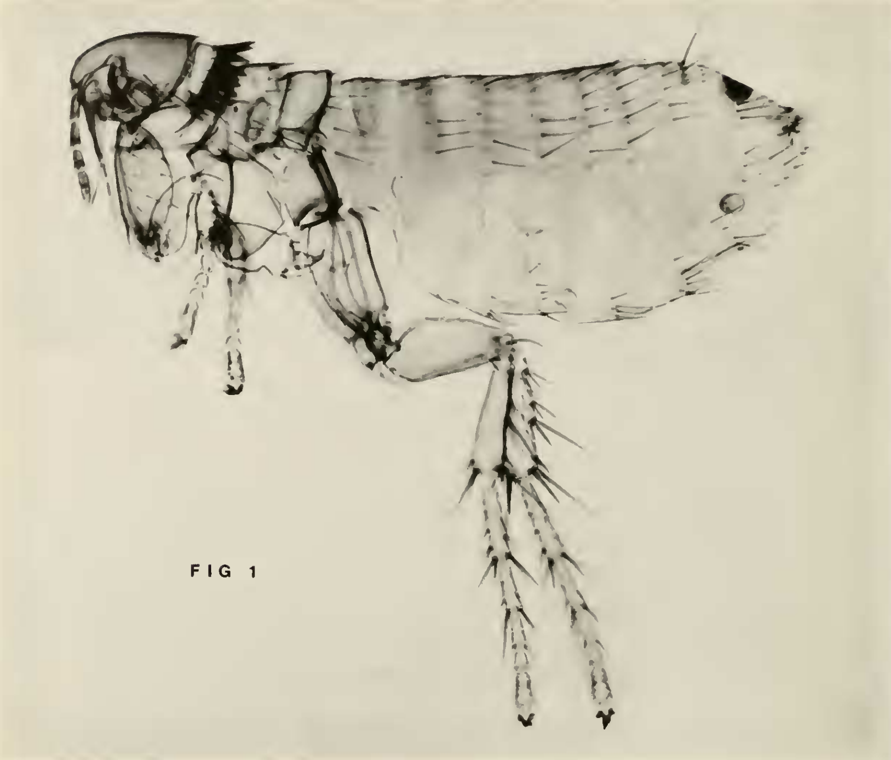

FIG 1

Fig. 1. *Thrassis fotus*, female, showing the single reduced middle leg. Body length, 2.0 mm.

As part of a study of small mammal populations on the shortgrass prairie, a female *Thrassis fotus* (Jordan) was collected which displayed teratogenic defects of the mesothorax and middle legs. This report describes this unusual flea.

MATERIALS AND METHODS

The flea was collected in the western division of the Pawnee National Grasslands, Weld Co., northeastern Colorado (40°45′N, 104°30′W). The site is shortgrass prairie at an elevation of 1500 m with an average annual precipitation of 300 mm. The prairie deer mouse, *Peromyscus maniculatus* (Wagner), and the thirteen-lined ground squirrel, *Spermophilus tridecemlineatus* (Mitchill), comprise approximately 90% of the individuals of the rodent community. The abnormal *T. fotus* was collected on 15 October 1974 from a *P. maniculatus* which had died while confined overnight inside a

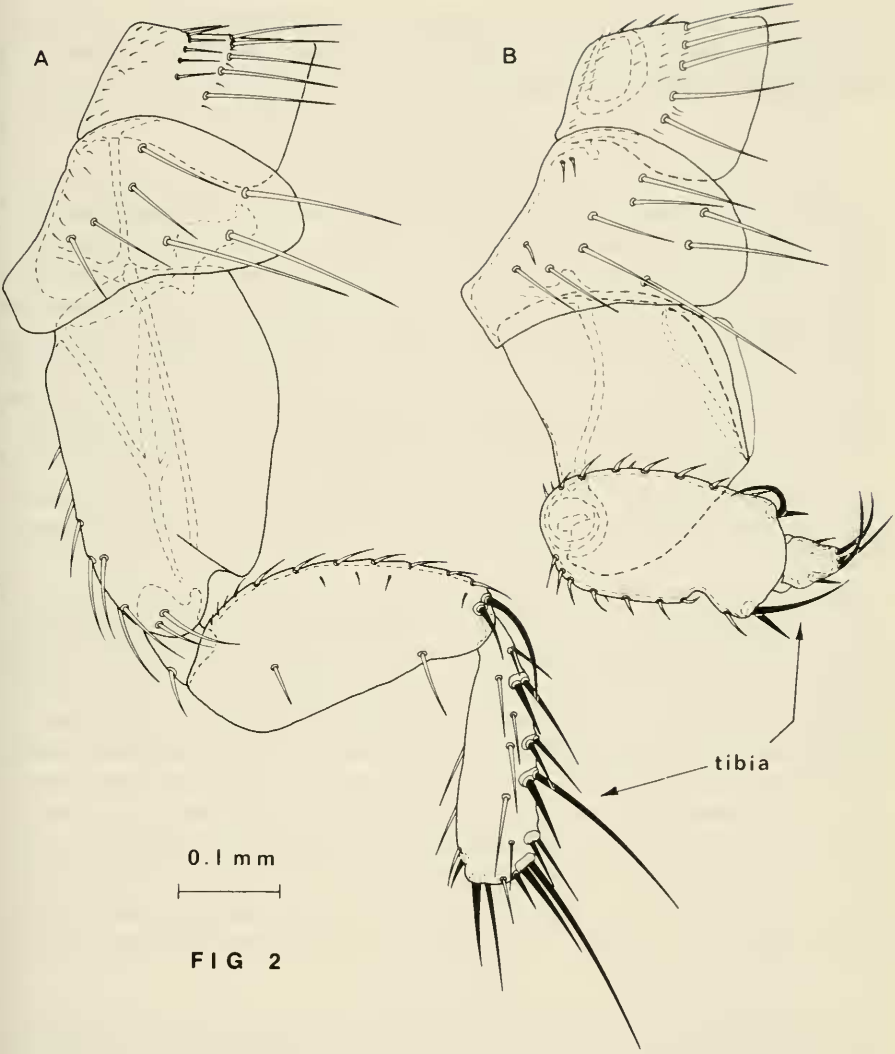

FIG 2

Fig. 2. Left lateral view of mesothorax and middle leg of *Thrassis fotus*. A, Normal, tarsus not illustrated. B, Teratogenic, tarsus absent (see text).

Sherman live trap. The flea was stored in 70% ethanol and later rehydrated, bleached in 10% KOH, and mounted for identification. The abnormalities were not noticed until after the flea had been bleached and mounted. Other fleas collected from *P. maniculatus* during the same period (14–16 October) were *Monopsyllus wagneri* (Baker) (25 ♂, 20 ♀), *Epitedia wenmanni wenmanni* (Rothschild) (1 ♀), and *Orchopeas* sp. (1 ♀). A normal female *T.*

fotus was also collected from the northern grasshopper mouse, *Onychomys leucogaster* (Wied-Neuwied), and this specimen is used for comparative purposes in the following description.

RESULTS

Fig. 1 is a photograph of the entire flea, and Fig. 2B shows the abnormal mesothorax and middle leg. For comparison, the normal morphology of a typical *T. fotus* collected from the same locality is illustrated (Fig. 2A).

Abnormalities in the mesothorax are: (1) The lack, on the left side, of a pleural rod except for dorsal and ventral thickenings (the rod is normally developed on the right side); and (2) presence of an internally sclerotized ring delineating a membranous area on the wall of the right anterior region of the mesonotum (apparently part of a distorted anterior phragma) and some of the large setae on this side bunched together and out of alignment.

Fusion and loss of segments of the two middle legs have resulted in only one reduced middle leg. This leg is neither right nor left but arises midventrally and is composed of a coxa, trochanter, femur, and tibia. The tarsus is absent.

The coxa is apparently the result of fusion between the right and left mesocoxae. Evidence to support this includes: (1) The coxa with one anterior and ventral margin but two dorsal and posterior margins; (2) two folds of less sclerotized cuticle, probably representing remnants of the medial walls, located between and joined to the two posterior margins; (3) presence of two pleural-coxal articulations but no sternal-coxal articulations since most of the medial walls have been lost in the fusion; (4) both lateral walls with a single unbranched outer internal ridge, the forked vertical thickening characteristic of the inner internal rod of the medial walls being absent; (5) absence of patches of small setae normally located anteriorly on the medial walls and no setae present along the anterior margin; and (6) absence of the partial oblique sutures of the lateral walls. In lateral view the coxa is shorter and rounder than normal.

The position of the trochanteral-coxal articulation has shifted slightly above and anterior to the normal position, and asymmetry in this articulation has caused the trochanter to project out to the left. This orientation and the position of the mounted specimen make observation of this segment very difficult.

The femur is near normal size, misshapen, and lies to the left of the coxa. The absence of lateral setae, the presence of both dorsal and ventral marginal setae, the presence of two pairs of preapical spiniform setae, and the presence of the short wavy cuticular striations characteristic of the medial walls, all suggest that this femur consists of two dorsal-medial halves. This could have resulted either through fusion of the left and right femora or through duplication of the dorsal-medial portion of one femur.

The leg's terminal segment is a very reduced tibia, and, like the femur, it has an identical setal pattern along both margins, suggesting that fusion or duplication has also occurred in this segment. In all other respects this particular specimen is quite normal.

DISCUSSION

Thrassis fotus occurs primarily on the thirteen-lined ground squirrel, *S. tridecemlineatus*, but has been found on other rodents, particularly *S. spilosoma* Bennett and *O. leucogaster* while records from *Peromyscus* spp. are rare (Stark, 1970). The abnormal *T. fotus* was the only individual of this collection found on the "wrong" host (*P. maniculatus*) although both *S. tridecemlineatus* and *O. leucogaster* were present at the site. This flea was most likely a straggler from one of these two species, but its physical deformity may have resulted in a lack of selectivity in its host choice. Alternatively, since this flea was probably raised in the nest of its preferred host, the impairment likely reduced its ability to maintain an association with its primary host. The fact that this five-legged flea was collected alive from an atypical host suggests that its survival was not precluded by the absence of functional middle legs. While the mesothorax and mesocoxae of fleas are involved with the jump, the major force is provided through the back legs (Rothschild et al., 1973, 1975). The role of the middle legs during the jump remains unclear, but these legs may be used to help the flea stabilize itself just prior to jumping, and they may assist, along with the back legs, in grasping on to a host at the end of a jump (Rothschild et al., 1975). However the question remains as to whether the scarcity of reported leg abnormalities in fleas is due to their low frequency of occurrence, their possible cause of high mortality in newly emerged adult fleas, or failure of observers to report such defects.

The specimen is deposited in the Siphonaptera Collection, British Museum (Natural History), London.

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